LAB06: Color image Processing (part2)

Objectives

The goals of this lab, you will be able to:

1. Write a user-defined function in MATLAB to increase the dynamic range in the the color image using histogram equalization.

2. Write a program in MATLAB to remove noise using smoothing spatial filtering, including median filtering and average filtering.

3. Write the program in MATLAB to sharpen a blurry image using simplified Laplacian mask filter.

4. Write the program in MATLAB for converting the original color image to obtain the negative color image.

5. Write the program in MATLAB to select a region of interest within an image based on color image segmentation.

Exercises

Note that you should create your own function in MATLAB as MATLAB User-defined function. It means that you cannot call MATLAB built-in function, which generates output in the same manner as your own function. You can use the images provided in the folder **\Google Drive\EGCI486-Image Processing\Second(2015-2016)\LABs\LAB06_Part2** for your exercises.

1) Color image Processing using histogram equalization

1.1 In order to increase the dynamic range in the image, write a program in MATLAB to perform histogram equalization on the color image. The histogram equalization of color image can be done by using three methods. First method is histogram equalized on all RGB components of image. Second method is histogram equalized on the Y component of YCbCr image only, and convert back to RGB image. Third method is histogram equalized on the I component of HSI image only, and convert back to RGB image. Take the following program

name: Procolorhist.m. When this program is used with the image "badexposure.jpg" result as shown in Figure 1.
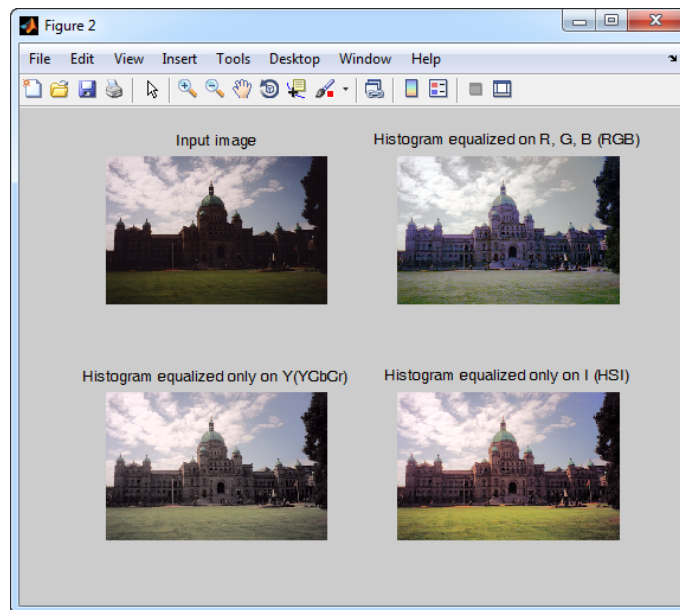

Figure 1: The result image of applying the histogram equalization on the same image by using different three methods.

2) Color image smoothing using averaging filter

2.1 Consider the twin boys image corrupted by Gaussian noise. Write a program in MATLAB to filter the noisy version of the twin boys image with a 3×3 standard average filter using zero padding. The color image smoothing can be done by using three methods. First method is smoothed on all RGB components of image. Second method is smoothed on the Y component of YCbCr image only, and convert back to RGB image. Third method is smoothed on the I component of HSI image only, and convert back to RGB image. Take the following program name: Procoloraver.m. When this program is used with the image "twin_boys_g.tif" result as shown in Figure 2.

- The standard average filter (3×3)

$$\frac{1}{9} \times \begin{array}{|c|c|c|} \hline 1 & 1 & 1 \\ \hline 1 & 1 & 1 \\ \hline 1 & 1 & 1 \\ \hline \end{array}$$
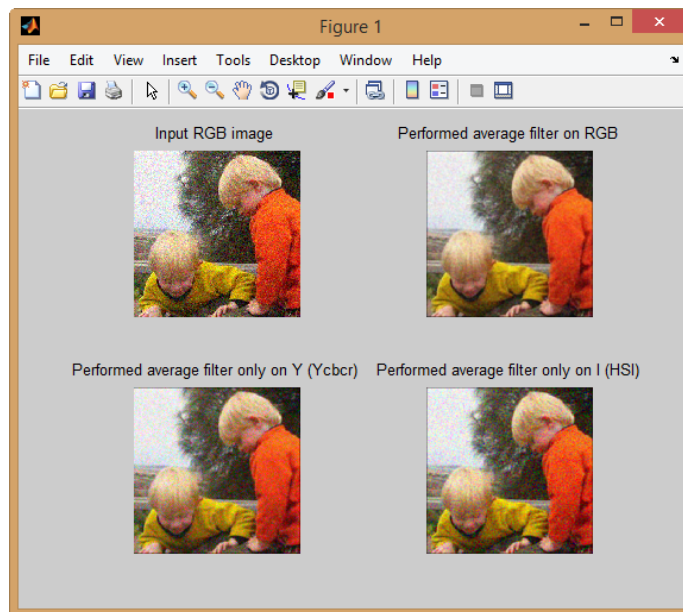
Figure 2: The result image of applying the 3×3 standard averaging filter on the same image by using different three methods.

2.2 Consider the twin boys image corrupted by salt and pepper noise. Write a program in MATLAB to filter the noisy version of the twin boys image with a 3×3 median filter using zero padding. The color image smoothing can be done by using three methods. First method is smoothed on all RGB components of image. Second method is smoothed on the Y component of YCbCr image only, and convert back to RGB image. Third method is smoothed on the I component of HSI image only, and convert back to RGB image. Take the following program name: Procolormedian.m. When this program is used with the image "twin_boys_sp.tif" result as shown in Figure 3.
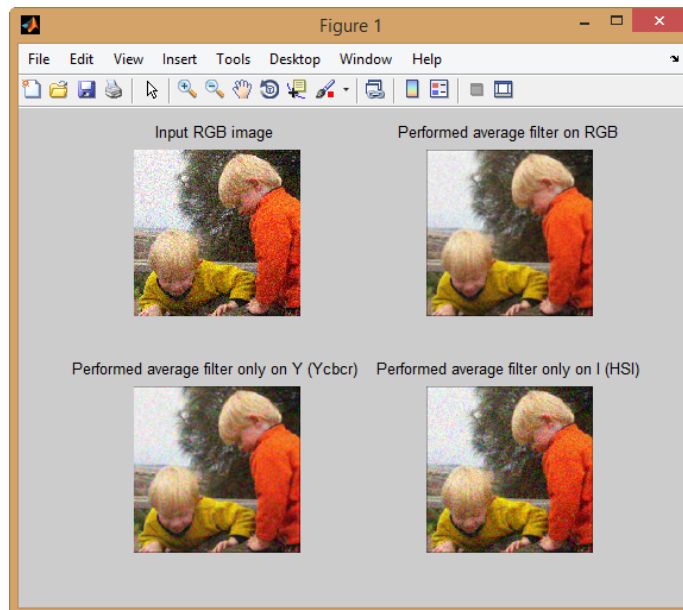
Figure 3: The result image of applying the 3×3 median filter on the same image by using different three methods.

3) Color image complement

3.1 Write a program in MATLAB for converting the original color image to obtain the negative color image, with the following program name: Procolorcomp.m. Using this program on the image "kodim23.jpg" should give you result as shown in Figure 4.
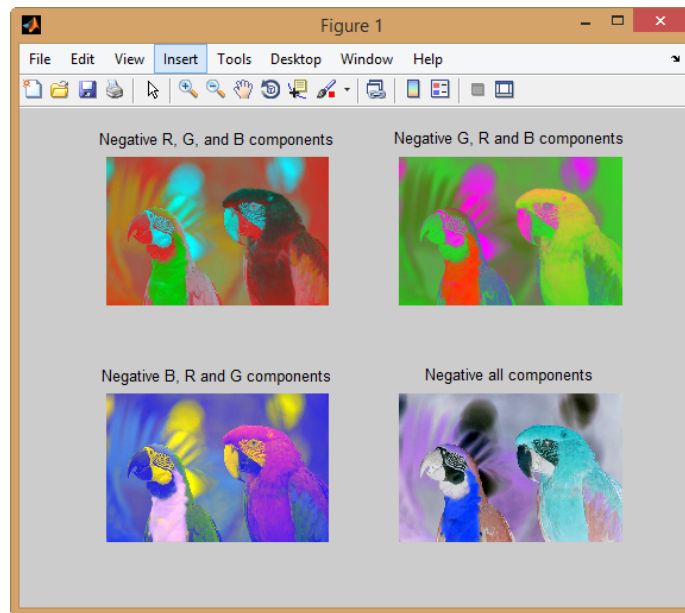
Figure 4: The negative color image resulted from applying the image negatives on the original color image.

4) Color image sharpening

4.1 Write a program in MATLAB to sharpen a blurry image with a simplified Laplacian mask filter using zero padding. The color image sharpening can be done by using three methods. First method is sharpened on all RGB components of image. Second method is sharpened on the Y component of YCbCr image only. Third method is sharpened on the I component of HSI image only. Take the following program name: Procolorsharpen.m. When this program is used with the image "flower_blurry.tif" result as shown in Figure 5.

- 3×3 Simplified Laplacian mask filter

-1	-1	-1
-1	9	-1
-1	-1	-1

Note that the simplified Laplacian mask filter can be done by combining from two filtering operations into a single filtering operation. To sharpen a blurry image, the detail of sharpening method can be divided into two operations. We firstly applied the

Laplacian filter on the blurry image. Secondly, we can obtained the sharpened image by subtracting the Laplacian filtered images from the blurry image.
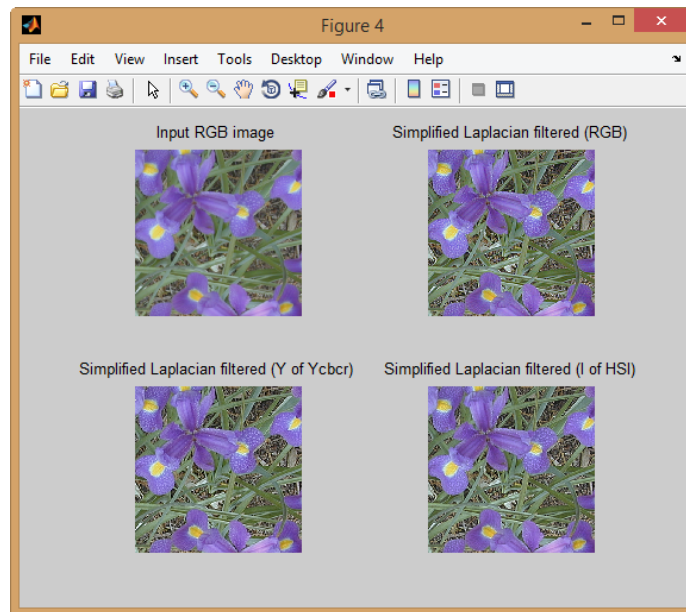

Figure 5: The result image of applying the 3×3 simplified Laplacian filter on the same image by using different three methods.

5) Color image segmentation

5.1 In order to select a region of interest, write a program in MATLAB for selecting a red ball within an image based on color. Take the following program name: Procolorseg.m. Using this program on the image "PuppyWithBall.jpg" should give you result as shown in Figure 6.
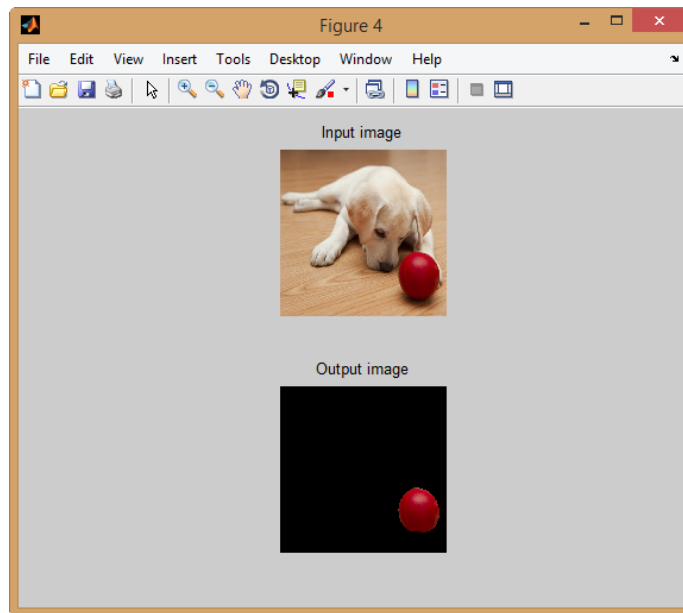
Figure 6: The red ball image resulted from applying the color image segmentation on the

RGB image.